Docket No. : M&N-IT 204
Application No. : 10/047,800

CERTIFICATION

I, the below named translator, hereby declare that: my name and post office address are as stated below; that I am knowledgeable in the English and German languages, and that I believe that the attached text is a true and complete translation of the German priority document bearing No. 101 02 456.8, filed in Germany on January 15, 2001. A certified copy of the German priority document was filed in the Patent Office on February 26, 2002.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Hollywood, Florida

Birgit Bartell

September 29, 2003

Lerner & Greenberg, P.A.
P.O. Box 2480
Hollywood, FL 33022-2480
Tel.: (954) 925-1100
Fax.: (954) 925-1101

M&N-IT 204

Description

Title of the invention: Housing-shaped shielding plate for the shielding of an electrical component.

The invention relates to a housing-shaped shielding plate for the shielding of an electrical component according to the precharacterizing clause of claim 1.

It is known to provide an optoelectronic transceiver with a shielding plate for electromagnetic shielding. Shielding plates of this type are often formed as housings which are fastened on a printed-circuit board and accommodate the transceiver in them. For the connection of a transceiver arranged in this way to an optical network, one end of the shielding plate or end of the housing is inserted through a rear wall of a metallic structure. Infra-red light is coupled into the transceiver or out of it via an optical plug-in connector, which is inserted in the region of the housing part protruding out of the rear wall into a connector receptacle of the transceiver or an adapter coupled to the transceiver.

At data transmission rates in the range of Gbits/s, unwanted spurious emissions occur, escaping in particular in the region of the connector, which generally represents the only discontinuity of the housing or shielding plate. Consequently, at these frequencies the components come into the range of the prevailing wavelengths in their mechanical dimensions. The shielding plate causes waveguide configurations to be produced. Since shielding plates guide the waves, instead of averting them, in the frequency range

mentioned, difficult-to-control spurious emissions occur in the region of the connector.

To avoid this problem, it is known to seal the shielding plate as much as possible. This takes place with to some extent complex mechanical structures, which in each case attempt to enclose the spurious radiation. At very high data rates between 2.5 and 10 Gbits/s, however, resonance effects of the shielding plate can occur (cavity resonances), making the shield lose its shielding effect. A further disadvantage of known solutions is that enclosing radio-frequency electromagnetic energy sometimes causes instances of strong line-bound coupling into the vicinity of the shield to take place. This leads to increasingly difficult-to-control spurious radiation problems.

The invention is accordingly based on the object of providing a shielding plate for receiving and shielding an electrical component which reduces spurious emissions as much as possible in the region of the connector of the component.

This object is achieved according to the invention by a shielding plate with the features of claim 1. Preferred and advantageous configurations of the invention are specified in the subclaims.

It is accordingly envisaged by the invention to provide on the shielding plate, in a region of the shielding plate which lies inside a metallic structure, elongate clearances through which the electromagnetic waves are specifically coupled out of the shielding plate. The invention is based on the idea of effectively emitting or coupling out radio-frequency energy through clearances in the shielding plate, at least for certain frequencies.

The metallic structure is, for example, a housing or the front or rear wall of a relatively large piece of electrical equipment.

This intentional coupling out of spurious radiation in the interior of the metallic structure has the effect that the spurious emissions are corresponding reduced in the region of the connector, which lies outside the metallic structure. The emission of electromagnetic waves into the space outside the shielding plate is reduced. Consequently, an emission is deliberately induced in a region of the shielding plate in which the spurious radiation cannot escape to the outside and consequently cannot be disruptive. The disruptive emission into the space outside is correspondingly reduced.

In a preferred configuration of the invention, the clearances are elongate slots or slot structures. The length of the slots is preferably $\lambda/2$ of the emitted interfering frequency, the slot acting as an antenna for the wavelength λ, in a way analogous to a dipole. In comparison with a dipole, the electric field strength E and the magnetic field strength H are reversed here, since the slot itself of course does not carry current.

The slots preferably run in the longitudinal direction of the shielding plate. It is nevertheless likewise possible for them to be formed transversely or at an angle in relation to the longitudinal direction of the shielding plate. In the latter case, it is provided in particular that they are formed as transverse radiators, which run substantially transversely in relation to a longitudinal side of the shielding plate. Furthermore, it may be envisaged to form in the shielding

plate a plurality of slots of different lengths, through which different wavelengths are coupled out to a greater degree.

So as not to put at risk the signal integrity in the interior of the metallic structure, in a preferred development a suitable absorber material, which absorbs electromagnetic waves of the emitted frequency, is applied to the slot structures according to the invention.

The invention is explained in more detail below on the basis of several exemplary embodiments with reference to the figures of the drawing, in which:

figure 1 shows the arrangement of a shielding plate in a metallic structure;

figure 2 shows a first exemplary embodiment of a shielding plate according to the invention;

figure 3 shows a second exemplary embodiment of a shielding plate according to the invention, and

figure 4 shows a third exemplary embodiment of a shielding plate according to the invention.

Figure 1 schematically shows the arrangement of a shielding plate 1 according to the invention with respect to a metallic structure 3, which partially surrounds the shielding plate 1. The metallic structure 3 is, in particular, a metallic housing or the front or rear wall of a relatively large piece of electrical equipment.

The shielding plate 1 is formed as a housing, which serves in particular for receiving an optoelectronic transceiver. The

housing-shaped shielding plate 1 is fastened on a printed-circuit board 2, which represents for example the main board of a computer.

The shielding plate 1 has a rear region 1a, which is arranged inside the metallic structure 3, for example the sheet-metal housing of a computer. All that is shown of the metallic structure is a housing rear wall 3, in which an opening 31 is formed. The shielding plate also has a front region 1b, which is inserted through the opening 31 of the shielding plate 1 and accordingly protrudes out of the metallic structure.

The transceiver mounted in the housing or inserted into it forms in the front housing region 1b a connector receptacle or an optical port 5, which serves for the coupling of an optical connector onto the transceiver. In the region of the optical port 5, there is an increased risk of a spurious emission of electromagnetic waves into the surroudings, since the port region represents a discontinuity of the shielding plate 1.

For electrical bonding of the shielding plate 1 to the housing rear wall 3, schematically represented contact springs 11, which are in electrical contact with the housing rear wall 3, are formed in the region where the plate passes through the opening 31.

Figure 2 shows a shielding plate according to the invention. It has a closed, or at least partly closed, structure with side walls 10a, 10b, an upper wall 10c and a rear wall 10d. It is possible to dispense at least partly with a base plate, provided that the housing is mounted directly on a printed-circuit board. A longitudinal slot 4 is formed in the shielding plate on the upper wall 10c at its rear region 1a, lying inside the metallic structure.

The longitudinal slot represents a slot antenna for those electromagnetic waves of which the wavelength is twice the length of the slot 4. Accordingly, the slot length is chosen such that it is equal to $\lambda/2$ of the frequencies most likely to be disruptive. At the same time, it is possible to form longitudinal slots of different lengths on the shielding plate, so that emission takes place over a certain frequency range. The longitudinal slot 4 preferably has a length of between 3.75 mm ($\lambda/2$ for 40 GHz) and 15 cm ($\lambda/2$ for 1 GHz).

The slots can be formed as simple punched apertures in the shielding plate and can accordingly be produced easily and at low cost. They can similarly be formed on the other sides 10a, 10b or 10d of the housing.

In the front region 1b of the housing 1 there is formed a schematically indicated connector receptacle or optical port 5 of the transceiver arranged in the shielding plate 1. The region 1b in this case protrudes through a cutout of a metallic housing rear wall, as represented in figure 1.

An alternative configuration of the invention is represented in figure 3. Here, slot structures 4' which run transversely or at an angle in relation to the longitudinal axis of the shielding plate 1, and preferably run in each case from longitudinal edge to longitudinal edge of the respective side of the housing, are formed in the rear region 1a of the housing.

In a development of the invention according to figure 4, an absorber material 6 has been placed onto the slot structures 4' in order to absorb the emitted electromagnetic radiation as much as possible. This may be, for example, an absorber

material such as that obtainable under the designation "C-RAM KRS" "C-RAM KFE" from Cuming Microwave, Aron, MA 02322, USA.

Similarly, it may also be envisaged to form a corresponding absorber material 6 on the slot structures of figure 1. The provision of an absorber material reduces the coupling out of spurious radiation into the interior of the metallic structure (of the computer housing), so that the risk of the signal integrity in the interior of the metallic structure being put at risk is reduced. However, it has been found that this risk is in any case very low.

The formation according to the invention of slot structures in the rear region of the shielding plate causes increased emission of spurious radiation into the interior of the metallic structure. As a result, the spurious radiation emerging from the connector region 5 and emitted into the surroundings is reduced.

The invention is not restricted in its implementation to the exemplary embodiments represented above. All that is important for the invention is that in part of a housing-shaped shielding plate which is located inside a metallic structure there are formed slot structures through which electromagnetic spurious radiation is specifically coupled out of the shielding plate and into the closed metallic structure.

Patent claims

1. A housing-shaped shielding plate for the shielding of an electrical component, in particular a radio-frequency, optoelectronic transceiver, with a first region, which can be arranged inside a metallic structure, and with a second region, which can be inserted through a cutout of the metallic structure, characterized in that in the first region (1a) of the shielding plate (1) there are elongate clearances (4, 4'), through which electromagnetic waves produced within the shielding plate (1) are coupled out of the shielding plate (1).

2. The shielding plate as claimed in claim 1, characterized in that the clearances are elongate slots (4).

3. The shielding plate as claimed in claim 2, characterized in that the elongate slots (4) have a length of $\lambda/2$ of the emitted electromagnetic waves.

4. The shielding plate as claimed in claim 2 or 3, characterized in that the elongate slots (4) run in the longitudinal direction of the shielding plate (1).

5. The shielding plate as claimed in at least one of claims 1 to 3, characterized in that the slots (4') run transversely or at an angle in relation to the longitudinal direction of the shielding plate (1).

6. The shielding plate as claimed in claim 5, characterized in that the slots (4') extend between the opposite edges of a side face of the shielding plate.

7. The shielding plate as claimed in at least one of claims 2 to 7, characterized in that a plurality of slots of different lengths are formed in the shielding plate (1).

8. The shielding plate as claimed in at least one of the preceding claims, characterized in that an absorber material (6), absorbing electromagnetic waves, is applied over the elongate clearances (4') formed in the shielding plate (1).

9. The shielding plate as claimed in at least one of the preceding claims, characterized in that the shielding plate (1) forms a housing for receiving the electrical components.

Abstract

Title of the invention: Housing-shaped shielding plate for the shielding of an electrical component.

The invention relates to a housing-shaped shielding plate for the shielding of an electrical component, in particular a radio-frequency, optoelectronic transceiver, with a first region (1a), which lies inside a metallic structure, and with a second region (1b), which can be inserted through a cutout of the metallic structure and has a receiving opening for the coupling of a connector. According to the invention, in the first region (1a) of the shielding plate (1) there are elongate clearances (4), through which electromagnetic waves produced within the shielding plate (1) are specifically coupled out of the shielding plate (1).

Figure 2